

# Conclusion

The seventh *Puget Sound Update* expands the base of knowledge about environmental conditions around Puget Sound. Monitoring of these conditions for the last 10 years has also helped us to understand how Puget Sound has changed over time. In the interest of continuing to increase our understanding of the Puget Sound environment, the *Update* supports recommendations for a number of further studies and follow up actions.

**Status.** Puget Sound environmental monitoring continues to provide evidence of environmental degradation in a number of areas of Puget Sound. Nearly 80 percent of the Puget Sound shoreline from Mukilteo to Tacoma has been altered. Water quality at a number of shellfish growing areas is poor enough to require restrictions on commercial harvest of shellfish. The degradation in these areas is a result of failing on-site sewage systems, poorly managed agricultural lands and other contaminant sources. Recent (1997) findings about sediment contamination in north Puget Sound further confirm the long-recognized pattern of contamination in Puget Sound's urban bays.

On the other hand, monitoring continues to show that most types of environmental degradation are not pervasive throughout Puget Sound. Many areas of the Sound do not show evidence of fecal or toxic contamination problems. Fecal contamination does not appear to threaten commercial shellfish harvest at many growing areas scattered throughout the Sound, including areas in the San Juan Islands, the straits of Juan de Fuca and Georgia, Admiralty Inlet, Penn Cove, Holmes Harbor, Possession Sound, Eld Inlet and Oakland Bay.

Monitoring and surveys have identified a number of Puget Sound organisms, especially marine fish (groundfish and forage fish), salmon and some birds, whose populations are in poor condition. These populations may be affected by environmental degradation in Puget Sound or by other factors, including harvest, changing predation pressures, or varying ocean and climatic conditions. One additional factor that may be affecting the Puget Sound ecosystem is the introduction and establishment of marine invasive species. As of 1998, scientists had documented the presence of more than 50 non-native species in Puget Sound.

**Trends.** Puget Sound monitoring indicates that environmental conditions and natural resource abundance continue to change. Some measures show improvements over time and others point to worsening conditions.

Improving trends are seen in declining levels of some contaminants and in the increasing numbers of harbor seals living in Puget Sound. Fecal contamination is declining at two shellfish growing areas where agencies and local citizens have committed to ongoing remedial actions. Toxic contamination in mussels from a number of locations around Puget Sound is declining, probably as a result of improved pollution control. The population of harbor seals living in Puget Sound has grown steadily over the past 20 years, though it appears to be stabilizing in many areas of the Sound.

Other measures provide evidence that continuing development and other environmental stressors are contributing to declining conditions. Fecal contamination is worsening at two commercial shellfish growing areas (only four were studied in detail for this report), probably the result of increased development of nearby lands

for residential and commercial uses. The incidence of liver lesions in English sole from most Puget Sound locations did not change from 1989 to 1998, but the risk of liver lesions in fish from Elliott Bay increased. Liver lesions in English sole have been associated with PAH contamination in sediments. An increase in the incidence of liver lesions in English sole from Elliott Bay indicates that PAH contamination in that area may be increasing.

Monitoring data and stock assessments indicate that populations, productivity and survival of a number of organisms that live in Puget Sound have declined in recent years. The size of the spawning run for all stocks of Pacific herring in Puget Sound has declined from a peak of more than 22,000 tons in 1980 to just over 10,000 tons in 1997 and 1998, though the spawning run recovered to just over 15,000 tons in 1999. Rockfish stocks in Puget Sound appear to have been declining over the past few decades, based on evidence of declines in the recreational catch and a 75 percent decline in spawning potential. As recently as the late 1980s, 20 percent of Puget Sound coho salmon survived the marine portion of their life cycle. For the 1995 brood, only 10 percent survived the marine environment to return to their spawning streams. Numbers of scoters and grebes over-wintering in northern Puget Sound have declined by 50 percent or more since the late 1970s.

**Recommendations for Further Actions.** The findings presented in this document suggest a number of further studies and follow-up actions. Actions are listed in the last section of each of the preceding chapters. Some of the more important recommendations include the following:

- Puget Sound's shoreline has been extensively altered by bulkheads, piers and other structures. This alteration affects the availability and function of soft-bottom nearshore habitats. Land owners and resource managers may need to establish protected areas; use alternative, less harmful approaches to protecting shoreline properties; and undertake habitat restoration projects to protect remaining nearshore habitats and to restore functions that have been lost as shorelines have been altered.
- Worsening water quality conditions at some shellfish growing areas reflect the continuing and growing impact of land development on Puget Sound's waters. Continued shellfish harvest in developed and developing areas of Puget Sound will require ongoing attention to appropriate land-use decisions, land management practices and operation and maintenance of septic systems, stormwater management facilities and other pollution control equipment.
- Monitoring results suggest that some areas of Puget Sound, including southern Hood Canal, Budd Inlet, Penn Cove and East Sound, are susceptible to water quality degradation if additional nutrients are introduced to the system. Decisions about the discharge of nutrients from point and nonpoint sources to these areas of Puget Sound should take into consideration the potential effects of the nutrient additions on the ecosystem.
- Additional study of toxic contamination near urban areas and in the vicinity of wastewater discharges is needed to better understand the distribution of problems, to support cleanup activities, and to understand the effects that toxic contaminants might have on the Puget Sound ecosystem. Information presented in this report suggests a need for further investigations in Everett Harbor, Sinclair Inlet and Elliott Bay.

- Additional information and analysis are needed to characterize the potential human health risks from consumption of Puget Sound shellfish and fish from contaminated areas. Specifically, additional information is needed on water quality conditions at recreational shellfish beaches that have not yet been characterized and classified.
- Widespread evidence of the declining population of Puget Sound marine organisms suggests the importance of new efforts to protect and recover populations. Recovery plans based on an ecosystem perspective will require additional information about the specific relationships among various Puget Sound species and the influences of various natural and human-caused environmental stresses on marine populations.

